

REMARKS

The claims being prosecuted in this application were claims 5-10, 12 and 13, with claims 1-4, 11 and 14-47 being withdrawn.

Claims have been amended to clarify the present invention. Claim 8 has been cancelled. Claims 48, 49 and 50 have been added to specify more specific embodiments of the present invention of an apparatus. Support for added claims 48-50 can be specifically found at page 90, line 6 to page 91, line 11 of the specification and the description in Figure 42.

Reconsideration and removal of the rejection of claims 5, 6, 7, 9 and 10, as anticipated under 35 U.S.C. §102(b) by Yoshinaga (U.S. 2002/0050508 A1) and of claims 12 and 13 as obvious in view of a combination of Yoshinaga and Okamoto (US 2002/0153130 A1) are respectfully requested in view of the present amendments to the claims and following remarks.

In the Office Action, it is alleged that Yoshinaga teaches an instrument and a component that is an apparatus (FIG. 4, 101 and 102), a machining means (51), a welding means (52) and a plate supply means (a table or moving base 11).

Yoshinaga teaches a compound machining device that uses a friction stir bonding tool. In Yoshinaga, work objects 101 and 102 are mounted on a base or table 11 and the table moved in a

direction X to be acted on by a tool 51 (cutting tool) or a tool 52 (friction stir bonding tool). Only one tool is usable at a time and are exchanged between a main shaft 35 and a tool storage device. There is no weld groove machining means taught or suggested in Yoshinaga for forming grooves for weld grooves in plates along the periphery of fluid channel grooves.

In addition, with respect to amended claims 6, 7, 9 and 10, these claims provide that the plate supply means supplies one plate from one direction and superimposes the same on another plate fed from another direction. Such an arrangement is not taught or suggested in Yoshinaga.

Also, it should be noted that Yoshinaga requires that his work objects 101 and 102 must be provided with convex portions 101b and 102b (see FIG. 5) so that abutted portions contact each other. Note that when the contact portions do not exist the bonded area will become retreated (see paragraph 0028).

The Okamoto references does not cure the deficiencies of Yoshinaga with respect to claims 12 and 13.

In view of the present amendments, claims 5-7, 9, 10, 12 and 13 are believed to be patentable over the cited art.

With respect to the new claims 48-50, these claims recite the characteristic features: "inserts a tip tool of a friction stir welding machine only into the second plate up to a position where the first plate and the second plate can be welded by frictional heat generated by rotating the tip tool".

That is, the claims 48 to 50 specify an arrangement so to insert the tip tool of the friction stir welding machine only into the second plate up to a position where the first plate and the second plate can be welded by frictional heat generated by rotating the tip tool, namely, up to a position (depth) where a plastic flow region generated by the frictional heat reaches not only the second plate, but also the first plate, without inserting the tip tool as far as the first plate having the fluid channel grooves machined therein, when welding the first plate and the second plate, in a superimposed state, by the friction stir welding machine.

Hence, the arrangement of claims 48-50 can obtain the following actions and effects:

1) An explanatory drawing, shown below, illustrates a state in which a tip tool 225a is inserted only into a second plate 203 to carry out friction stir welding. A portion A in this explanatory drawing represents a plastic flow region generated by the frictional heat of the tip tool 225a. If, at this time, the tip tool 225a is further inserted as far as a first plate 202, the plastic flow region A may affect (reach) a wall surface 208a of a fluid channel groove 208 of the first plate 202, destroying the wall surface 208a. Destruction of the wall surface 208 induces a decrease in the

channel sectional area of the fluid channel groove 208, and increases the pressure loss of the fluid flowing through the fluid channel groove 208.

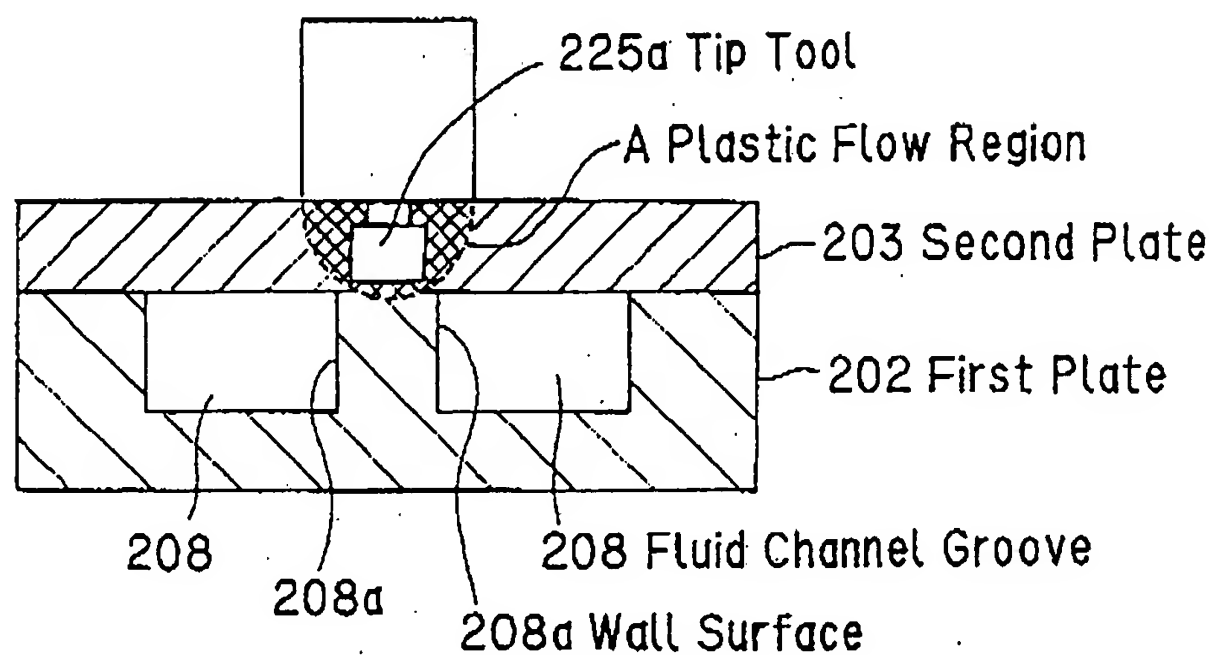
In this case, if the tip tool 225a can be inserted to a position remote from the fluid channel groove 208, the insertion of the tip tool 225a into the first plate 202 would be able to prevent the wall surface 208a from being destroyed under the influence of the plastic flow region A. However, if two fluid channel grooves 208 are provided in proximity, as shown in FIG. 41B and FIG. 41C, the tip tool 225a cannot be inserted to a position remote from the fluid channel groove 208.

That is, when two fluid channel grooves 208 are provided in proximity, as illustrated in the explanatory drawing, even if it is attempted to position the tip tool 225a away from the fluid channel groove 208 (even if it is attempted to displace the tip tool 225a leftward in the drawing) in order prevent the destruction of the wall surface 208a of the right-hand fluid channel groove 208 in the drawing under the influence of the plastic flow region A, the wall surface 208a of the other fluid channel groove 208 is destroyed by the influence of the plastic flow region A.

If the tip tool 225a is inserted into the second plate 203 alone, as recited in the claims 48 to 50, friction stir welding of the plates 202 and 203 can be performed, without destruction of any of the wall surfaces 208a of the two closely located fluid channel grooves 208 by the influence of the plastic flow region A. In other words, if the tip tool 225a is inserted only into the second plate 203,

a plurality of fluid channel grooves 208 can be provided in close relationship. Thus, the degree of freedom of machining of the fluid channel groove 208 is improved, and the density of the fluid channel grooves 208 can be increased.

< EXPLANATORY DRAWING >



2) The insertion of the tip tool only into the second plate results in a lower resistance imposed on the tip tool than the insertion of the tip tool into the first plate, when the tip tool is moved while following the outer periphery of the fluid channel grooves. Thus, the life of the tip tool can be lengthened. Moreover, the traveling speed of the tip tool can be increased to quicken friction stir welding. Furthermore, the tip tool can be thinned, and the spacing between the adjacent fluid channel grooves can be decreased accordingly.

3) If the tip tool is inserted up to the first plate, the reaction force of the first plate against plastic flow becomes so great that the second plate may float responsive to this reaction force, producing a clearance between the first plate and the second plate. The first plate and the second plate may have one side measuring as long as several meters. In friction stir welding such large plates, it may be impossible to prevent floating of the second plate, even if the boundaries of the first plate and the second plate are held down by press means. When the tip tool is inserted only into the second plate, by contrast, the reaction force of the first plate against plastic flow is so low that the floating of the second plate can be prevented.

4) The arrangement for insertion of the tip tool only into the second plate leads to a small width of the joining surfaces of the first plate and the second plate by friction stir welding (plastic flow), in comparison with the insertion of the tip tool as far as the first plate. However, joining strength enough to withstand the pressure of the fluid flowing through the fluid channel groove can be ensured.

None of the cited references disclose the aforementioned characteristic of claims 48-50: "inserts a tip tool of a friction stir welding machine only into the second plate up to a position where the first plate and the second plate can be welded by frictional heat generated by rotating the tip tool". Applicants thus believe that claims 48-50 are patentable and should also be allowed.

In view of the present amendment to the claims and the above remarks, Applicants believe that claims 5-7, 9, 10, 12, 13 and 48-50 are patentable and early allowance thereof is respectfully requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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